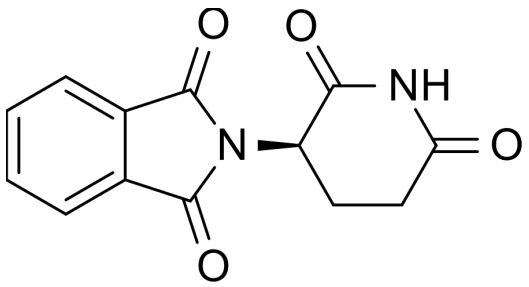
iGEM 2015

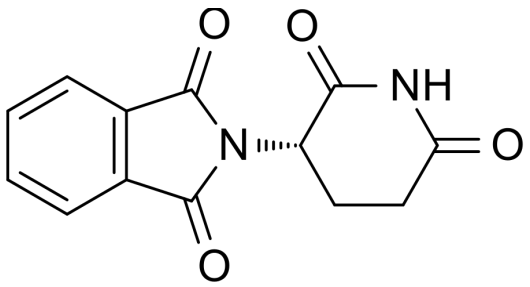
MycoMimic

Thalidomide

- 1957
- 10000 children born with complications
- 50% survived



(R)-thalidomide



(S)-thalidomide

Overview

- Genetic engineering
- Develop organisms with useful applications
- Humanitarian – Golden Rice
- Environmental – Bt cotton

Benefits

- Express genes of interest

e.g. biocatalysis

- Develop organisms with desired applications

e.g. draught-resistant crops

- Replace defective genes

e.g. gene therapy, Cystic Fibrosis

iGEM – what is it?

MIT, Cambridge, Massachusetts
Research & modelling

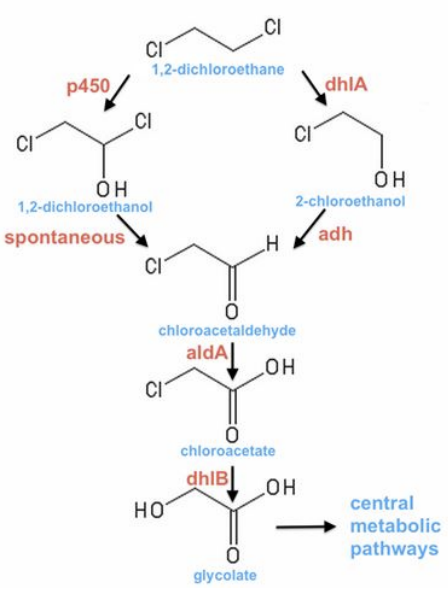
TRANSPARENT AND OPEN SCIENCE

Dr Nicholas Coleman

- Senior Lecturer
- School of Molecular Biosciences
- 17 publications 2010-14
- Role of microorganisms in health and environment

iGEM Sydney - 2013

- Biodegradation of chloroethane
- Botany Bay pollution
- Degradation observed
- Problems with gene design
- Low activity



Modelling - 2013

$$\frac{d\alpha_{out}}{dt} = -\Psi S J(\alpha_{out}, \alpha_{in})$$

$$\frac{d\alpha_{in}}{dt} = S J(\alpha_{out}, \alpha_{in}) - k_{cat\,C}\, C \frac{\alpha_{in}}{K_{M\,C} + \alpha_{in}}$$

$$\frac{d\gamma}{dt} = k_{cat\,C}\, C \frac{\alpha_{in}}{K_{M\,C} + \alpha_{in}} - k_{cat\,D}\, D \frac{\gamma}{K_{M\,D} + \gamma}$$

$$\frac{d\delta}{dt} = k_{cat\,D}\, D \frac{\gamma}{K_{M\,D} + \gamma} - k_{cat\,E}\, E \frac{\delta}{K_{M\,E} + \delta}$$

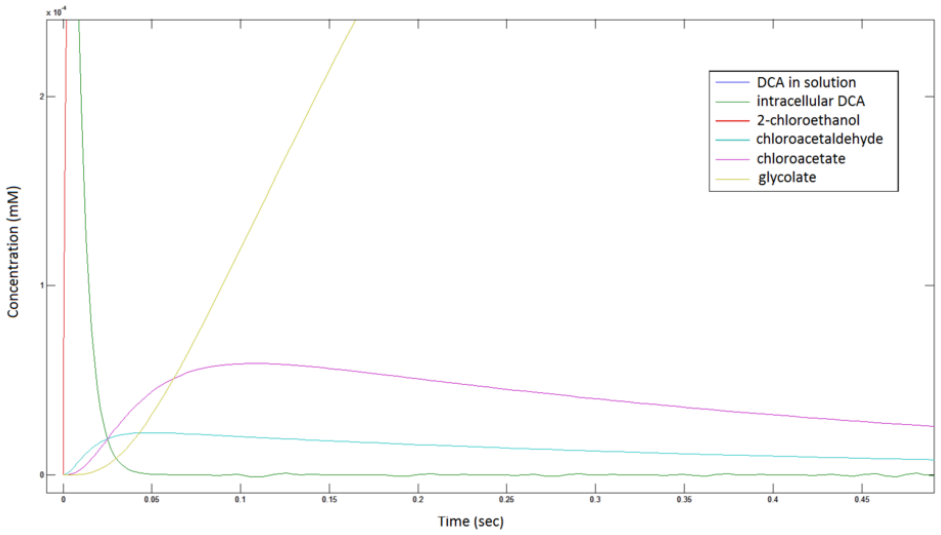
$$\frac{d\varepsilon}{dt} = k_{cat\,E}\, E \frac{\delta}{K_{M\,E} + \delta} - 1.5789 * 10^{-10}\,;\ \varepsilon > 0$$

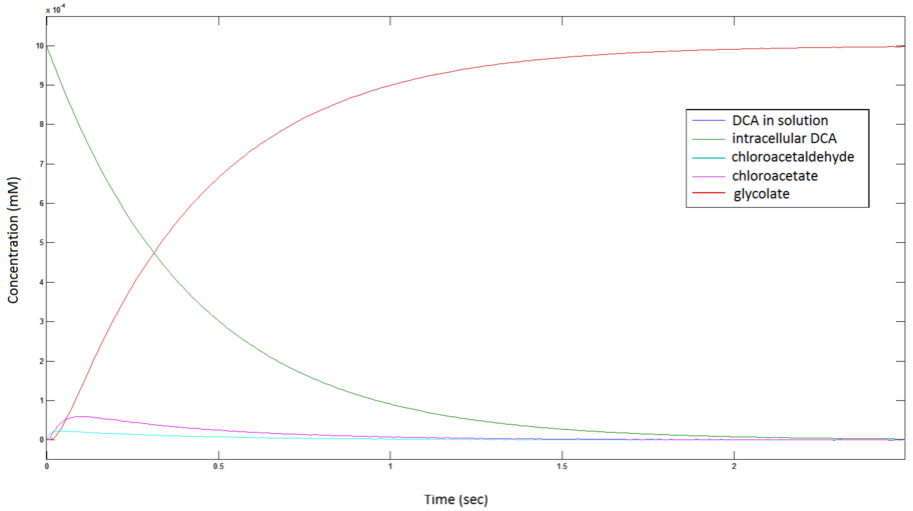
$$\frac{d\Psi}{dt} = 5 * 10^{6}\ cells/_{mL}\ \textit{given that glycolate is present}$$

DCA diffusion from solution into cell

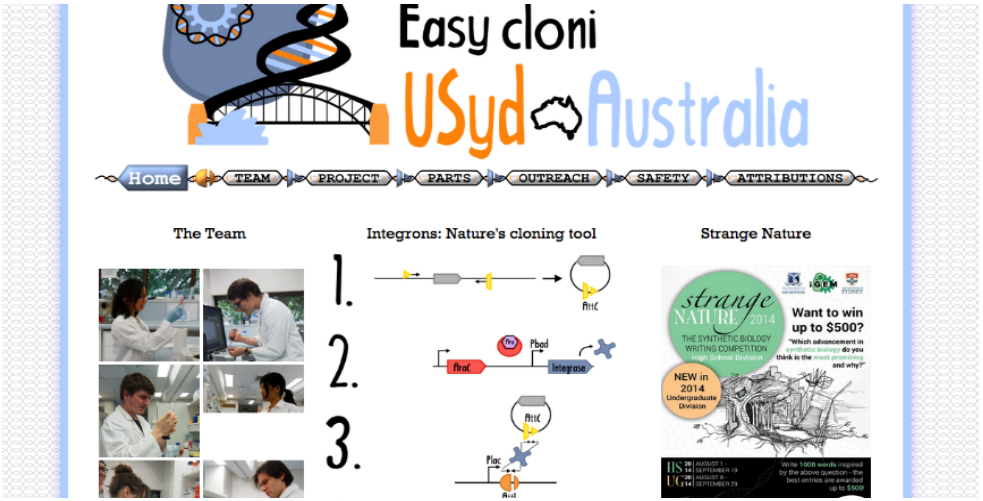
intracellular metabolic pathway

cellular growth





MORE THAN SCIENCE – wiki



MORE THAN SCIENCE- Outreach

Syd Uni designer genomes in world competition

Download audio | show transcript

Saturday 6 June 2015 12:41PM

It began in 2003 at MIT in Boston. Undergraduate teams of science students compete using the latest technology to design genomes or other complex molecules to solve real world problems or make current processes more efficient. Gaia Herrmann and Harrison Steel are part of the 2015 team from The University of Sydney. They describe their project and the possibilities using synthetic biology and

IMAGE: GAIA HERRMANN PREPARES A CENTRIFUGE (SYD UNI)

Saturday 12 noon
Repeated: Thursday 9pm

Presented by Robyn Williams

IN THIS PROGRAM

Charming spiders - Saturday 6 June 2015

Download

Spiders: they're bigger in cities
12:05 PM

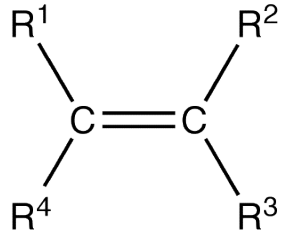
Sydney snake once common, now endangered
12:12 PM

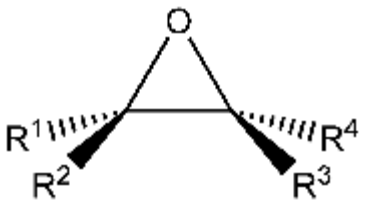
MORE THAN SCIENCE- Outreach

Outreach - Competition

MycoMimic - Our Project

- Develop Genetically Modified host capable of epoxide synthesis





Aims:

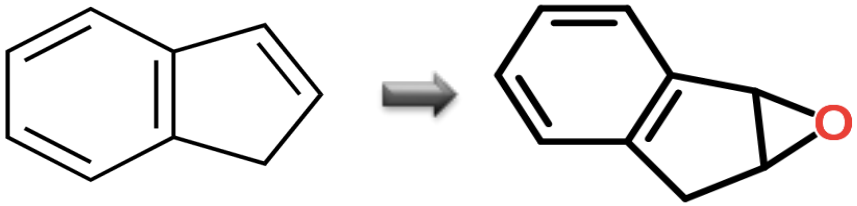
- High enzyme activity
- Fast growing host
- Easily manipulated host

Applications

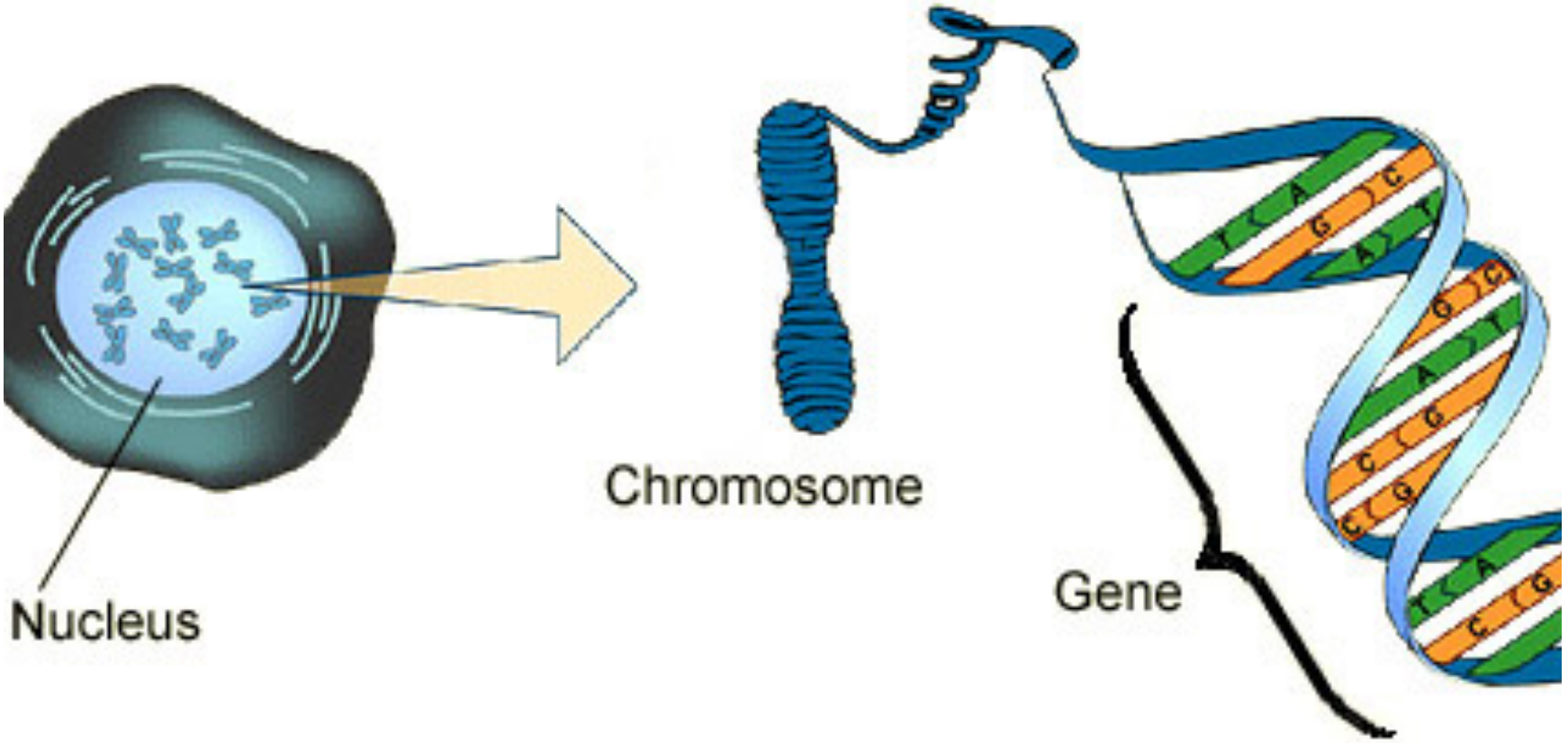
- Ethane oxide important raw material

e.g. Pharmaceuticals, textile, polymers

- Further optimisation → HIV drug

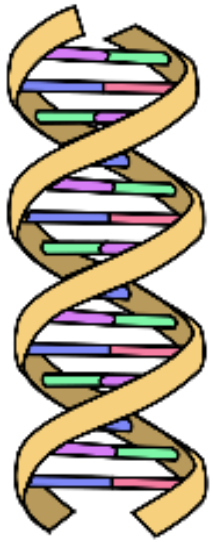


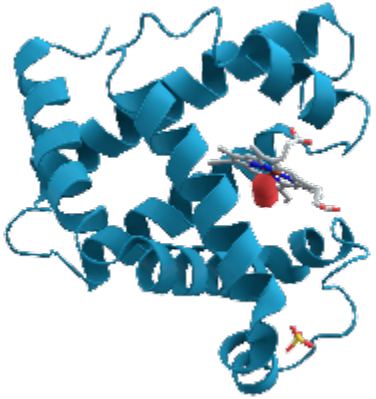
Lets get into the SCIENCE!



How do genes become functional?

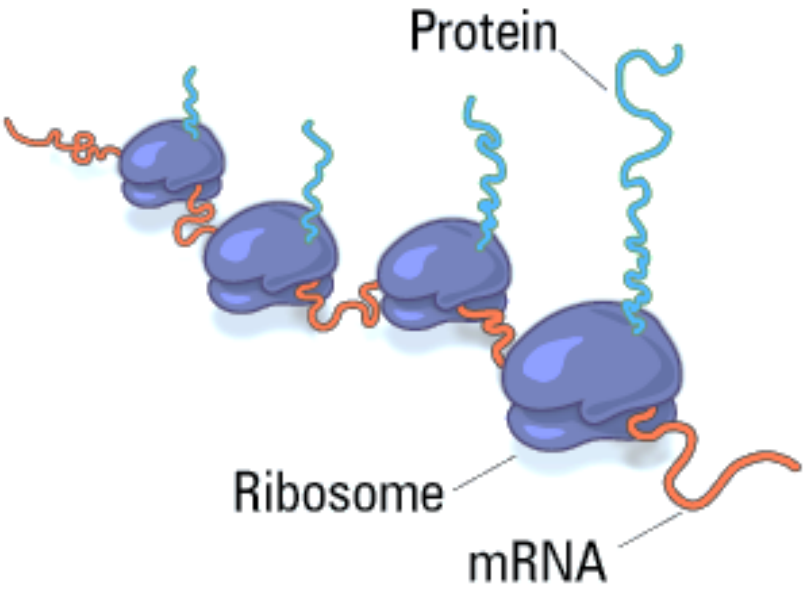
DNA → RNA → Protein



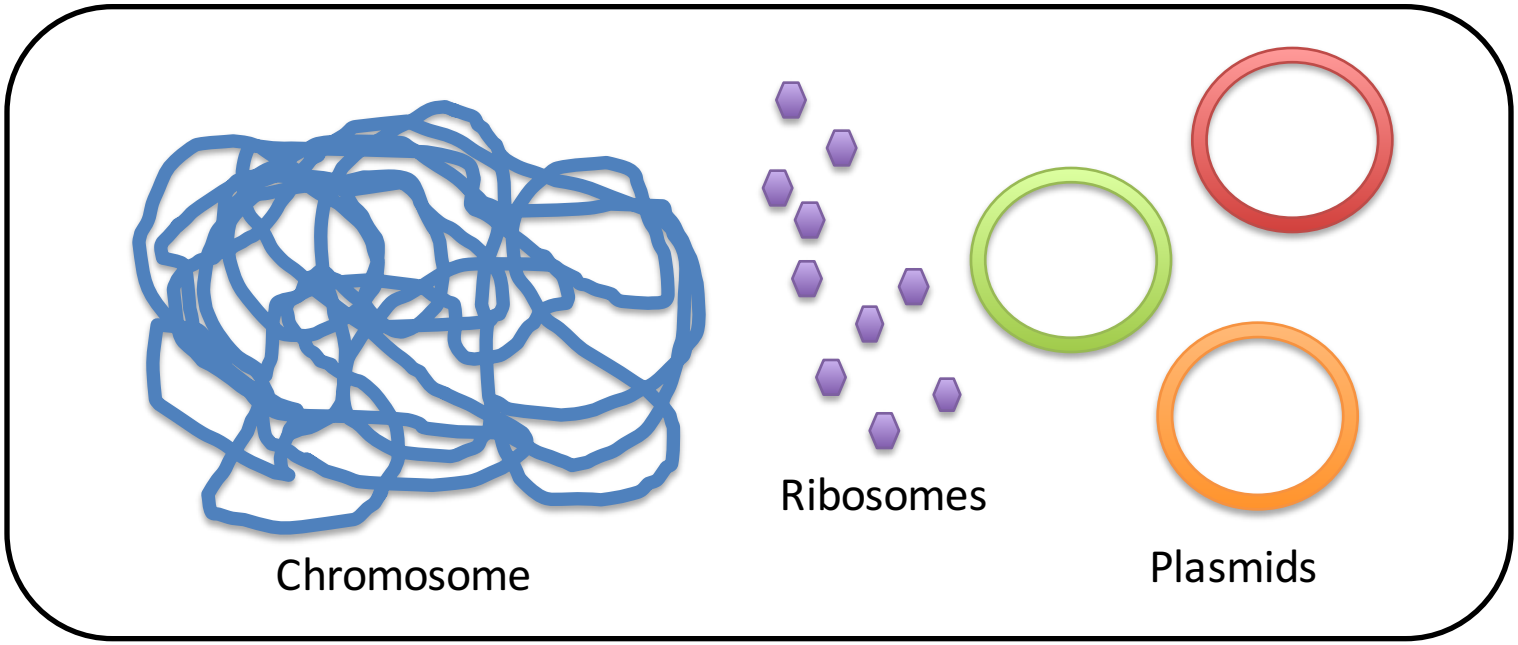


Ribosomes – “Protein Factory”

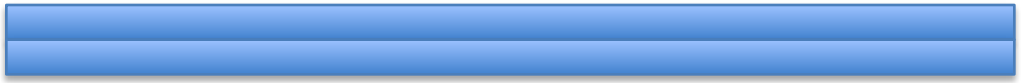
- Scan ‘barcode’ → ‘price’
- Scan RNA → protein



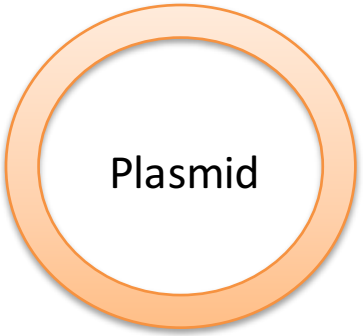
Bacteria - *E.coli*

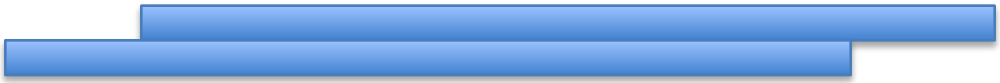


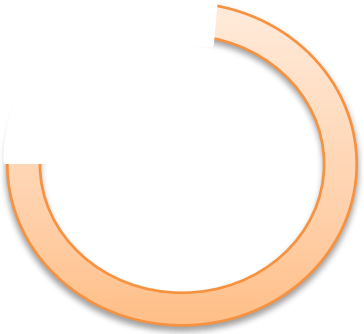
STEP 1: CUT DNA AND PLASMID

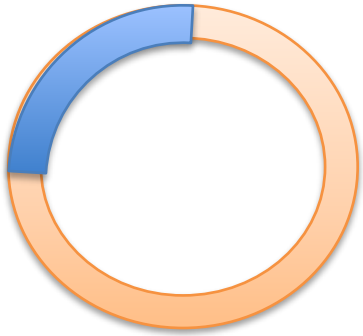


DNA (containing gene of interest)

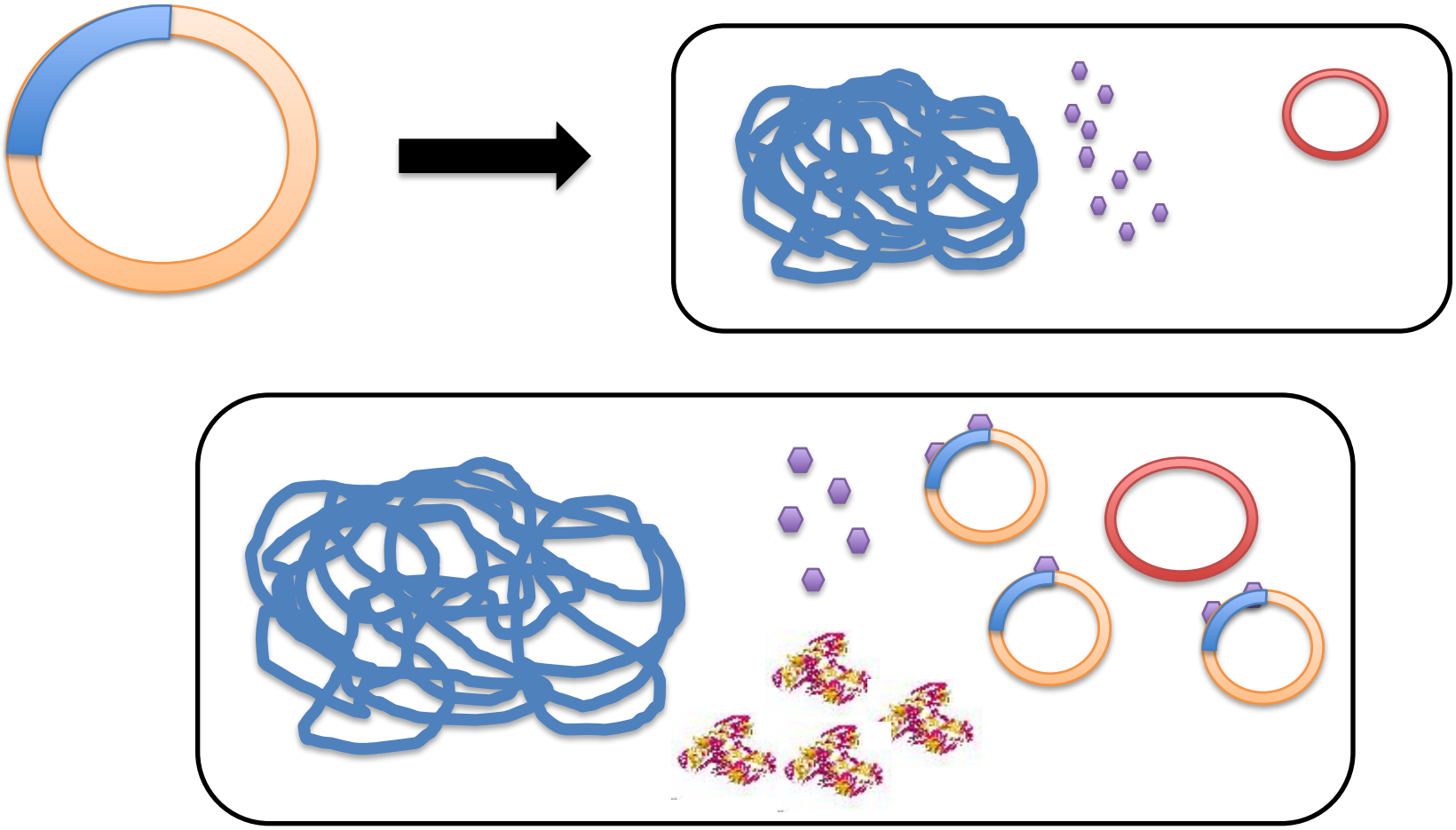






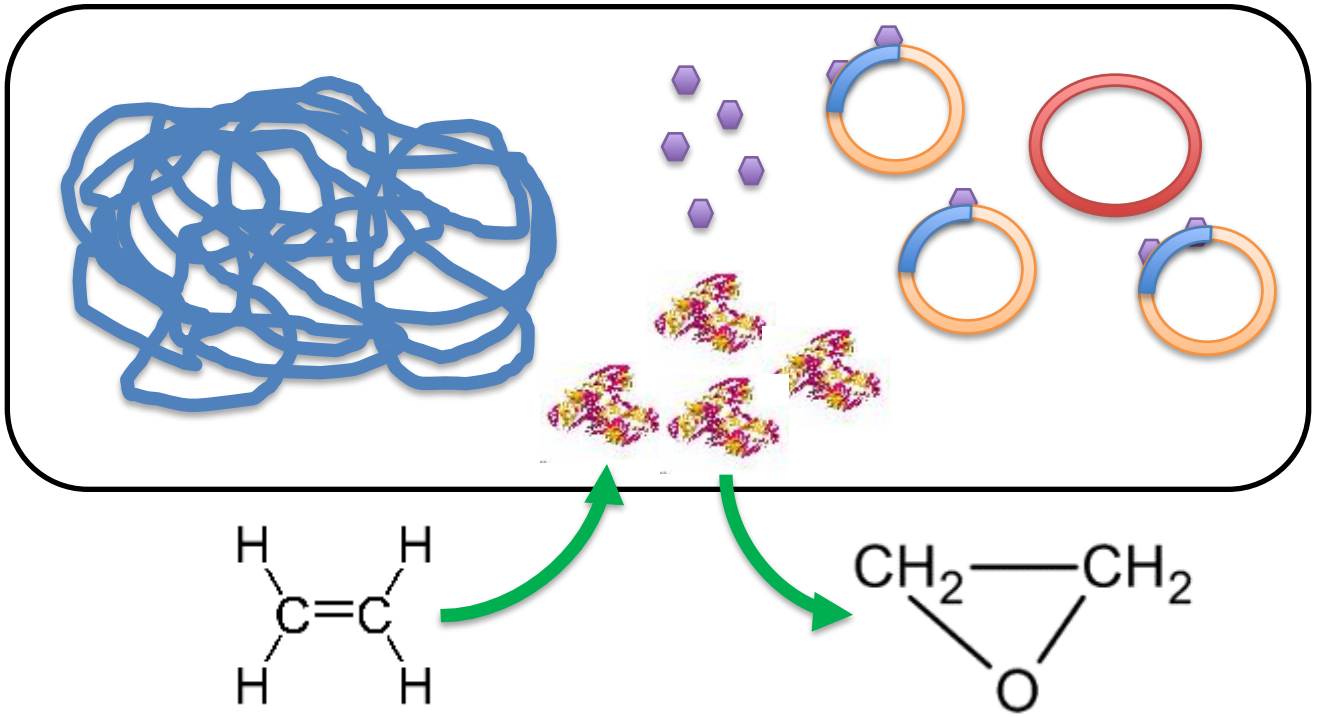


STEP 2: INSERT INTO BACTERIAL CELLS TO GROW



Monooxygenase (MO)

- Inserted gene
- Enzyme

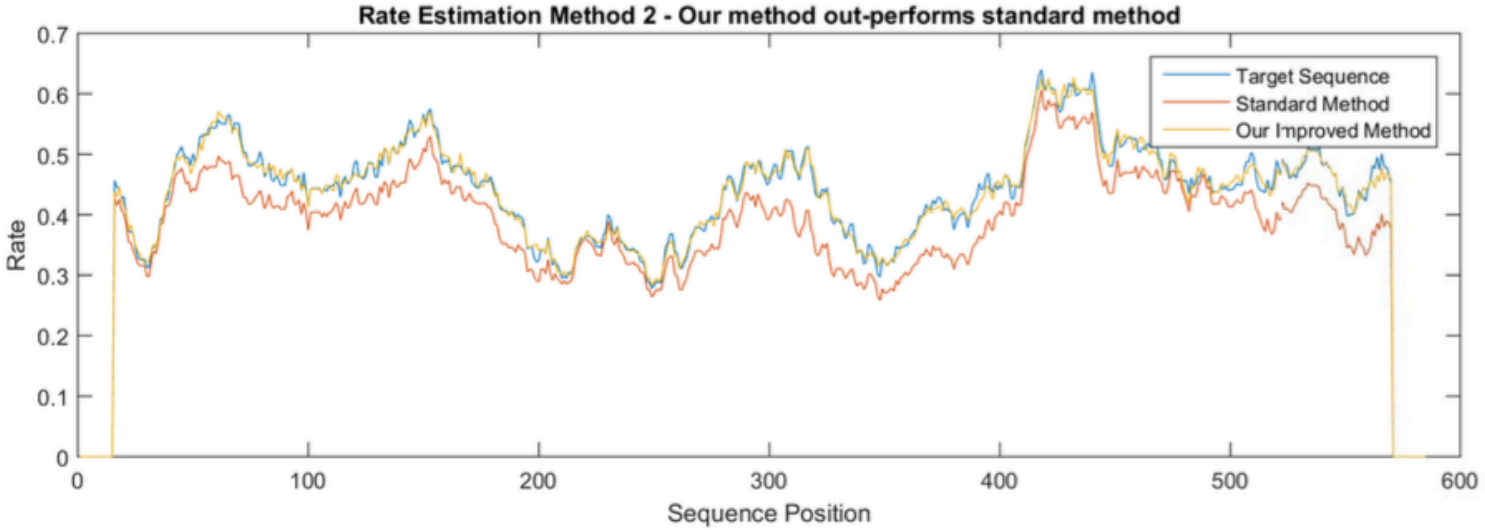


Modelling

Information ⇔ quality of protein

DNA sequence ⇔ translation rate

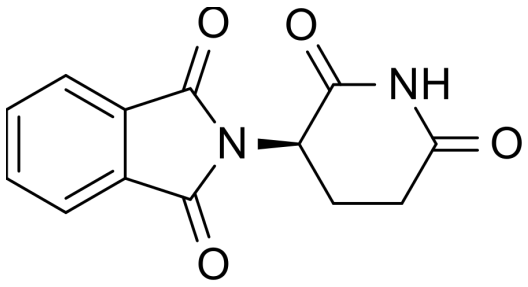
Modelling Example



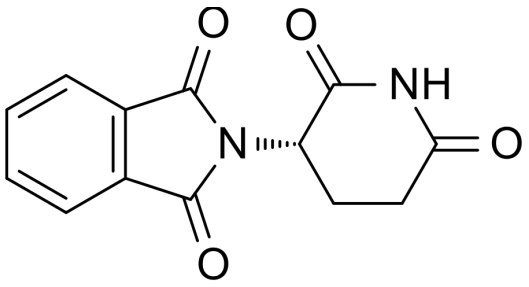
Thalidomide

- So what happened to the story?

Could have been prevented with biocatalysis.



(R)-thalidomide



(S)-thalidomide

Four Way Test

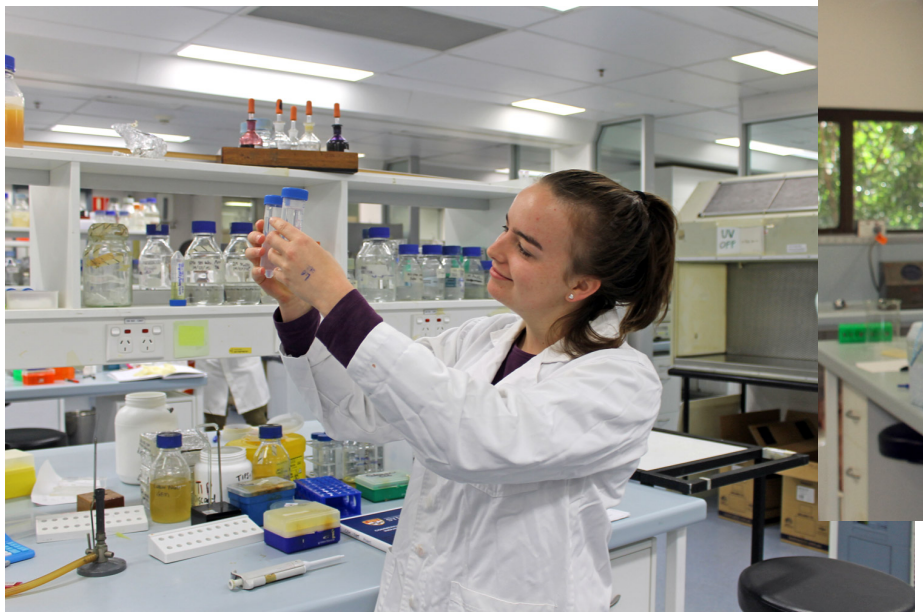
- Is it the truth?
- Is it fair to all concerned?
- Will it build goodwill and better friendships?
- Will it be beneficial to all concerned?

UNIVERSITY OF SYDNEY - iGEM

Sponsorship Opportunities

School of Molecular Biosciences
Building G08, Maze Crescent
The University of Sydney
Darlington, NSW, 2006,
Australia

iGEM Sydney Team 2015



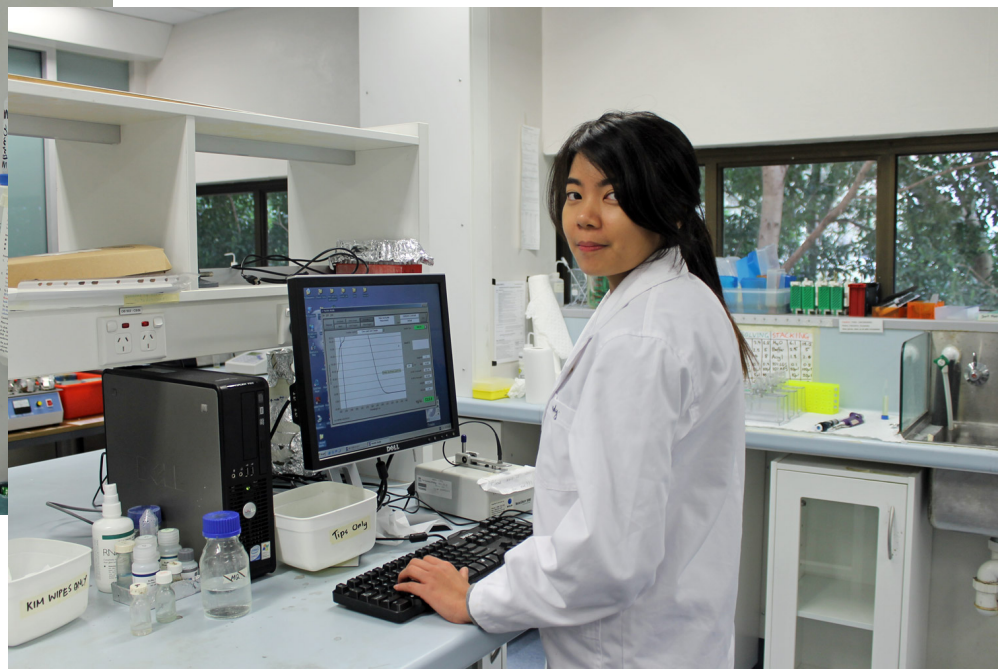
Elizabeth - Leader
Molecular biology & genetics
Ancient History
Performance Studies

Mark – Lab Leader
Biochemistry
Biology

iGEM Sydney Team 2015

Gaia

Biochemistry
Molecular biology &
genetics



Sandi

Microbiology
Molecular biology &
genetics

iGEM Sydney Team 2015

Mahiar
Biochemistry
Mathematics

Harry
Engineering
Physics
Mathematics

Thank YOU